FASTENER IDENTIFICATION AND TORQUE DATA

1. DESCRIPTION

This section contains information on the correct usage and identification of bolts, flat washers, lock washers, nuts, lock nuts, fittings and torque data. The nuts, bolts, and washers used on the airplane are in accordance with Air Force Navy Specifications, Military Specifications, and National Aircraft Standards.

2. MAINTENANCE PRACTICES

A. Bolts

Bolts can be identified by the marking(s) located on the head of each bolt. When securing a fastener, use the torque specifications from the following tables. (See Figure 20-601)

When torquing fasteners which do not have a specific torque pattern called out, refer to the general torque patterns shown. (See Figure 20-602)

CAUTION: Composite and non-composites require different torque values. Make sure to select the correct torque table.

B. Self Locking Nuts

When torquing a self-locking nut, the nut should be run down on the threads of the bolt until the nut almost contacts the mating surface. The amount of torque required to run the nut down (friction drag torque) should be measured and added to the amount of torque specified for the fastener.

Repeated removal and installation will cause the self-locking nut to lose its locking feature. They should be replaced when they are no longer capable of maintaining the minimum prevailing torque.

CAUTION: Never use a tap in a self locking nut or nutplate. Discard these parts, if this has occurred. Never install a self locking nut or nutplate backwards on a bolt. Discard these parts if this has occurred.

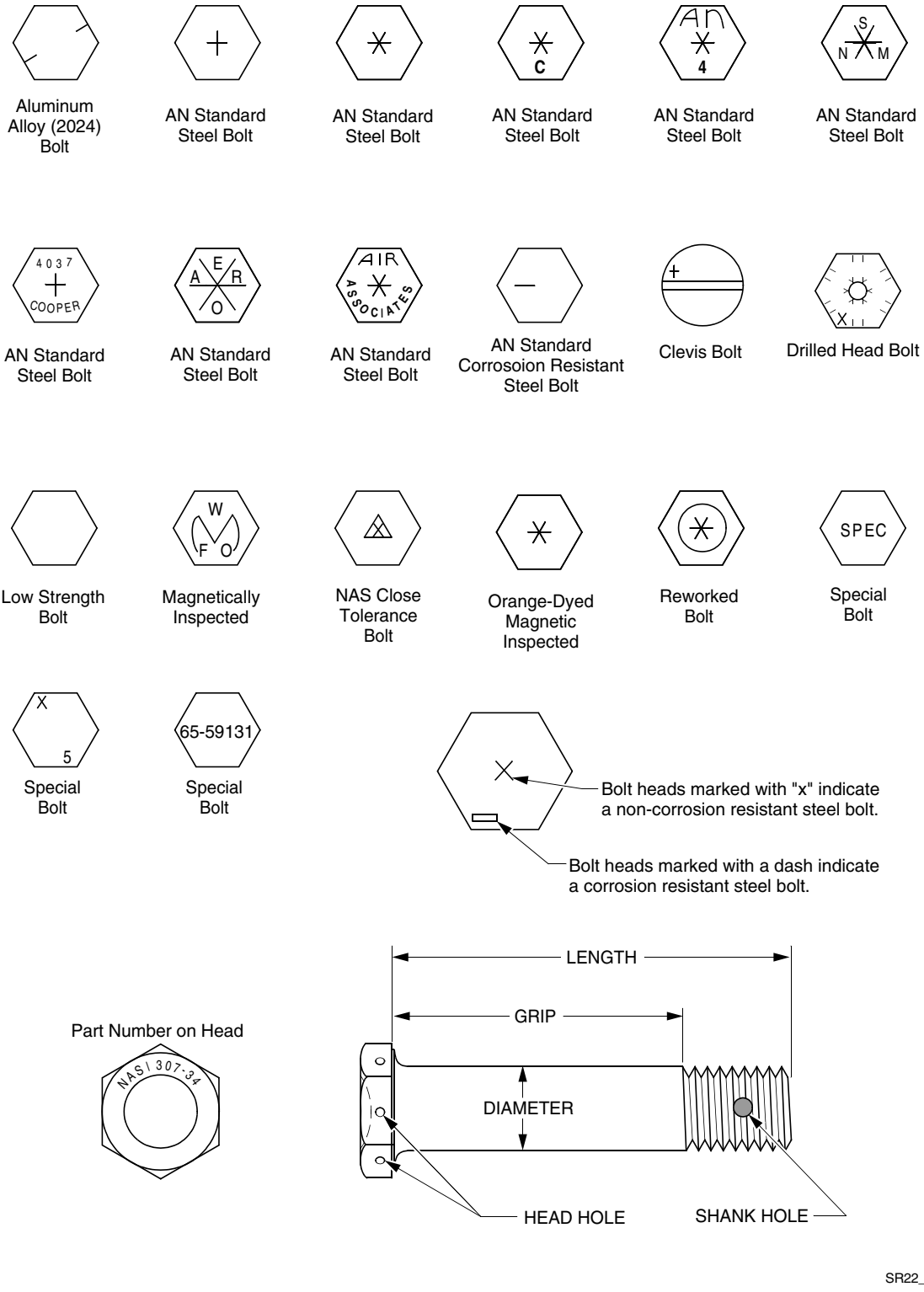
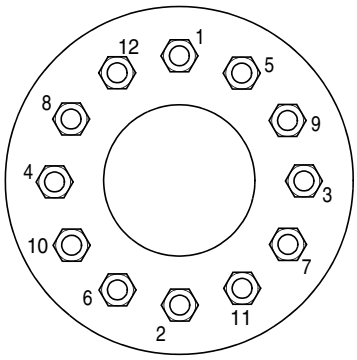
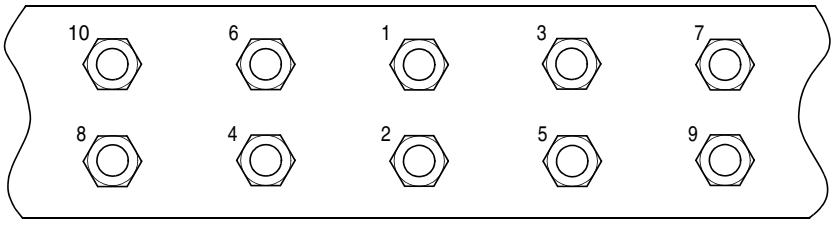


Figure 20-601
Bolt Identification



TYPICAL CIRCULAR PATTERN TORQUING SEQUENCE



TYPICAL LINEAR PATTERN TORQUING SEQUENCE

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Figure 20-602
General Torque Pattern

Item	AMM Chapter/ Section Reference	Inch Pounds		Nm	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
Propeller mounting nuts	61-10	840.0	960.0	92.4	105.6
Propeller mounting bolts	61-10	264.0	264.0	29.0	29.0
Propeller governor nuts	61-20	155	175	17.0	19.2
Spark plugs	72-00	300.0	360.0	33.9	40.7
Engine mount to firewall bolts (1/4”)	71-20	75.0	100.0	8.5	11.3
Engine mount to firewall bolts (1/2”)	71-20	456.0	480.0	50.1	52.8
Nose landing gear spindle nut	32-20	(Refer to 32-20)	(Refer to 32-20)	(Refer to 32-20)	(Refer to 32-20)
Nose wheel axle nut	32-20	Preload 150 Final 20	Preload 150 Final 40	Preload 17.0 Final 2.3	Preload 17.0 Final 4.5
Main Landing Wheel Nut	32-41	(Refer to 32-41)	(Refer to 32-41)	(Refer to 32-41)	(Refer to 32-41)
Main landing gear upper attach fitting to rib fitting nuts	32-10	25	50	2.82	5.65
Main landing gear fitting to canted rib clamp bolts	32-10	160	190	18.1	21.5
Main wing attachment bolts	57-10	400	500	45.2	56.5
Main wing spanner nuts	57-10	1200	1400	135.6	158.2
Brass exhaust nuts	78-10	100	110	11.0	12.1
Nose landing gear aft mounting bolts	32-20	480	690	52.8	75.9
Engine mount bolts (1/2 inch)	71-20	468	480	51.5	52.8

Figure 20-603
Specific Torque Requirements

NON-COMPOSITE STRUCTURE Torque Specifications for High Strength Steel Tension Nuts and Bolts with FINE Threads					
Item	**Thread Size**	**Inch Pounds**		**Nm**	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL TENSION NUTS AN310 AN315 AN363 AN365 MS17825 MS20365 MS21045 NAS1021 NAS679 NAS1291 STEEL TENSION BOLTS MS20004 thru MS20024 NAS144 thru NAS158 NAS333 thru NAS340 NAS583 thru NAS590 NAS624 thru NAS644 NAS1303 thru NAS1320 NAS6603 thru 6620 NAS172 NAS174 NAS517	10-32	25	30	2.8	3.3
	1/4”-28	80	100	8.8	11.0
	5/16”-24	120	145	13.2	16.0
	3/8”-24	200	250	22.0	27.5
	7/16”-20	520	630	57.2	69.3
	1/2”-20	770	950	84.7	104.5
	9/16”-18	1,100	1,300	121.0	143.0
	5/8”-18	1,250	1,550	137.5	170.5
	3/4”-16	2,650	3,200	291.5	352.0
	7/8”-14	3,550	4,350	390.5	478.5
	1”-14	4,500	5,500	495.0	605.0
	1-1/8”-12	6,000	7,300	660.0	803.0
	1-1/4”-12	11,000	13,400	1210.0	1474.0

Figure 20-604
Torque Specifications (Sheet 1 of 8)

NON-COMPOSITE STRUCTURE Torque Specifications for High Strength Steel Shear Nuts and Bolts with FINE Threads					
Item	**Thread Size**	**Inch Pounds**		**Nm**	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL SHEAR NUTS AN320 AN364 NAS1022 MS17826 MS20364 STEEL SHEAR BOLTS NAS464 NAS6203 thru NAS6220 NAS1103 thru NAS1120	10-32	15	20	1.7	2.2
	1/4”-28	50	60	5.5	6.6
	5/16”-24	70	90	7.7	9.9
	3/8”-24	120	150	13.2	16.5
	7/16”-20	300	400	33.0	44.0
	1/2”-20	450	550	49.5	60.5
	9/16”-18	650	800	71.5	88.0
	5/8”-18	750	950	82.5	104.5
	3/4”-16	1,600	1,900	176.0	209.0
	7/8”-14	2,100	2,600	231.0	286.0
	1”-14	2,700	3,300	297.0	363.0
	1-1/8”-12	3,600	4,400	396.0	484.0
	1-1/4”-12	6,600	8,000	726.0	880.0

Figure 20-604
Torque Specifications (Sheet 2 of 8)

NON-COMPOSITE STRUCTURE Torque Specifications for Standard Steel Shear Nuts with FINE Threads					
Item	Thread Size	Inch Pounds		Nm	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL SHEER NUTS AN320 AN364 NAS1022 MS17826 MS20364 MS21042 MS21083 MS21245	8-36	7	9	0.8	1.0
	10-32	12	15	1.3	1.7
	1/4”-28	30	40	3.3	4.4
	5/16”-24	60	85	6.6	9.4
	3/8”-24	95	110	10.5	12.1
	7/16”-20	270	300	29.7	33.0
	1/2”-20	290	410	31.9	45.1
	9/16”-18	480	600	52.8	66.0
	5/8”-18	660	780	72.6	85.8
	3/4”-16	1,300	1,500	143.0	165.0
	7/8”-14	1,500	1,800	165.0	198.0
	1”-14	2,200	3,300	242.0	363.0
	1-1/8”-12	3,000	4,200	330.0	462.0
	1-1/4”-12	5,400	6,600	594.0	726.0

Figure 20-604
Torque Specifications (Sheet 3 of 8)

NON-COMPOSITE STRUCTURE Torque Specifications for Standard Steel Tension Nuts and Bolts with FINE Threads					
Item	**Thread Size**	**Inch Pounds**		**Nm**	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL TENSION NUTS AN310 AN315 AN363 AN365 NAS1021 MS17825 MS21044 MS21045 MS21046 MS20365 MS20500 NAS679 STEEL TENSION BOLTS AN3 thru AN20 AN42 thru AN49 AN73 thru AN81 AN173 thru AN186 MS20033 thru MS20046 MS20073 MS20074 AN509NK9 MS24694 AN525NK525 MS27039	8-36	12	15	1.3	1.7
	10-32	20	25	2.2	2.8
	1/4”-28	50	70	5.5	7.7
	5/16”-24	100	140	11.0	15.4
	3/8”-24	160	190	17.6	20.9
	7/16”-20	450	500	49.5	55.0
	1/2”-20	480	690	52.8	75.9
	9/16”-18	800	1,000	88.0	110.0
	5/8”-18	1,100	1,300	121.0	143.0
	3/4”-16	2,300	2,500	253.0	275.0
	7/8”-14	2,500	3000	275.0	330.0
	1”-14	3,700	4,500	407.0	495.0
	1-1/8”-12	5,000	7,000	550.0	770.0
	1-1/4”-12	9,000	11,000	990.0	1210.0

Figure 20-604
Torque Specifications (Sheet 4 of 8)

NON-COMPOSITE STRUCTURE Torque Specifications for Standard Steel Tension Nuts and Bolts with COARSE Threads					
Item	**Thread Size**	**Inch Pounds**		**Nm**	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL TENSION NUTS AN310 AN315 AN363 AN365 NAS1021 MS17825 MS21044 MS21045 MS21046 MS20365 MS20500 NAS679 STEEL TENSION BOLTS AN3 thru AN20 AN42 thru AN49 AN73 thru AN81 AN173 thru AN186 MS20033 thru MS20046 MS20073 MS20074 AN509NK9 MS24694 AN525NK525 MS27039	8-32	12	15	1.3	1.7
	10-24	20	25	2.2	2.8
	1/4”-20	40	50	4.4	5.5
	5/16”-18	80	90	8.8	9.9
	3/8”-16	160	185	17.6	20.4
	7/16”-14	235	255	25.9	28.0
	1/2”-13	400	480	44.0	52.8
	9/16”-12	500	700	55.0	77.0
	5/8”-11	700	900	77.0	99.0
	3/4”-10	1,150	1,600	126.5	176.0
	7/8”-9	2,200	3,000	242.0	330.0
	1”-8	3,700	5,000	407.0	550.0
	1-1/8”-8	5,500	6,500	605.0	715.0
	1-1/4”-8	6,500	8,000	715.0	880.0

Figure 20-604
Torque Specifications (Sheet 5 of 8)

NON-COMPOSITE STRUCTURE Torque Specifications for Standard Steel Shear Nuts with COARSE Threads					
Item	Thread Size	Inch Pounds		Nm	
		Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
STEEL SHEER NUTS AN320 AN364 NAS1022 MS17826 MS20364 MS21042 MS21083 MS21245	8-32	7	9	0.8	1.0
	10-24	12	15	1.3	1.7
	1/4”-20	25	30	2.8	3.3
	5/16”-18	48	55	5.3	6.1
	3/8”-16	95	110	10.5	12.1
	7/16”-14	140	155	15.4	17.1
	1/2”-13	240	290	26.4	31.9
	9/16”-12	300	420	33.0	46.2
	5/8”-11	420	540	46.2	59.4
	3/4”-10	700	950	77.0	104.5
	7/8”-9	1,300	1,800	143.0	198.0
	1”-8	2,200	3,000	242.0	330.0
	1-1/8”-8	3,300	4,000	363.0	440.0
	1-1/4”-8	4,000	5,000	440.0	550.0

Figure 20-604
Torque Specifications (Sheet 6 of 8)

COMPOSITE STRUCTURE Torque Specifications For FINE Thread Hex-head Tension And Shear Bolts, Or Any Bolted Structure With Combinations Of Composite And Metallic Parts				
Thread Size	Inch Pounds		Nm	
	Minimum Dry Torque	Maximum Dry Torque	Minimum Dry Torque	Maximum Dry Torque
10-32	15	20	1.7	2.2
1/4”-28	25	30	2.8	3.3
5/16”-24	50	60	5.5	6.6
3/8”-24	80	95	8.8	10.5
7/16”-20	150	170	16.5	18.7
1/2”-20	220	245	24.2	27.0

Figure 20-604
Torque Specifications (Sheet 7 of 8)

Minimum Prevailing Drag Torque for Reused Self-locking Nuts					
Fine Thread			Course Thread		
Thread Size	Inch-Pounds	Nm	Thread Size	Inch-Pounds	Nm
7/16”-20	8	0.9	7/16”-14	8	0.9
1/2”-20	10	1.1	1/2”-13	10	1.1
9/16”-18	13	1.5	9/16”-12	14	1.6
5/8”-18	18	2.0	5/8”-11	20	2.3
3/4”-16	27	3.1	3/4”-10	27	3.1
7/8”-14	40	4.5	7/8”-9	40	4.5
1”-14	55	6.2	1”-8	51	5.8
1-1/8”-12	73	8.2	1-1/8”-8	68	7.7
1-1/4”-12	94	10.6	1-1/4”-8	88	9.9

Figure 20-604
Torque Specifications (Sheet 8 of 8)

C. Calculating Torque (See Figure 20-605)

CAUTION: Over-torquing of fasteners can result in failed fasteners and/or components. Under torquing a fastener can result in premature wear of the fastener and/or the fastening material which can result in failure of the component and/or fastener.

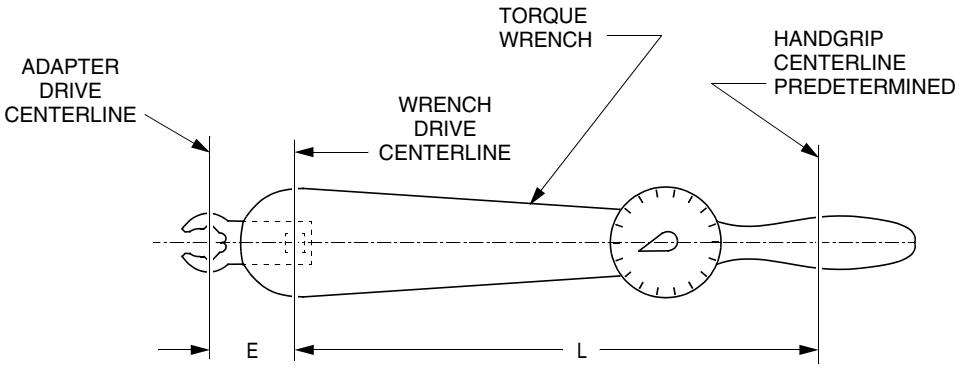
Note: Observe torque values and the installation of the recommended safetying device for every fastener. Impact-type wrenches should never be used on any fastener whose torque is crucial. If a nut is slightly over torqued, it must be loosened and then re-torqued to the correct value. Never back off a nut or a bolt and leave it un-torqued. Exceeding the maximum recommend torque is not permissible.

To assure an accurate torque measurement, a smooth and even motion must be applied. Whenever a bolt is torqued on the head side instead of torquing the nut, additional resistance (friction drag torque) may occur due to the friction of the shank during rotation. This could result in an under-torqued fastener. The value (friction drag torque) observed from the torque wrench indicator during the initial tightening phase of the bolt (before seating of the bolt has been accomplished), must be added to the torque value given in the specified torque table. When checking friction drag torque, use a torque wrench which allows the friction drag torque to fall in the middle of the overall range of the torque wrench.

When using a torque wrench with an adapter that changes the distance from the torque wrench drive centerline to the adapter centerline, compensation must be made for the extra leveraged gained. New torque specifications must be calculated before the wrench is used. To calculate the new torque specifications, use the formula in Figure 20-605. (See Figure 20-605)

(1) Requirements for Calculating Torque

- (a) When selecting a torque wrench, select one that has the required torque specification in the middle of the overall range of the torque wrench. When lower torque specifications are called out, always use an inch-pound torque wrench or a smaller foot-pound torque wrench. Use only calibrated torque wrenches that have been certified.
- (b) Calibrate the torque wrench and recheck calibration frequently to assure accuracy.
- (c) Thoroughly clean and dry all threads and fasteners prior to torquing.
- (d) Torque only to the specified range; stopping instantly at the correct torque.
- (e) When using a torque wrench adapter be certain to allow for the additional extension length when torquing.
- (f) Sheet metal screws and screws tightened to nutplates should be tightened firmly.
- (g) Always start the nut or bolt by hand prior to the torquing process.
- (h) Screws using dimpled washers should be drawn tight enough to eliminate the crown of the washer.
- (i) Specified torques must be considered dry torques.
- (j) Castellated nuts requiring cotter pins should be tightened to low torque value. Torque can be increased to install cotter pin, but should never exceed maximum torque value.
- (k) When nut cannot be tightened within given torque values to install cotter pins, remove nut, install a washer, then reinstall nut.



Formula $\frac{T \times L}{L + E} = Y$

T = 135 LB. IN.

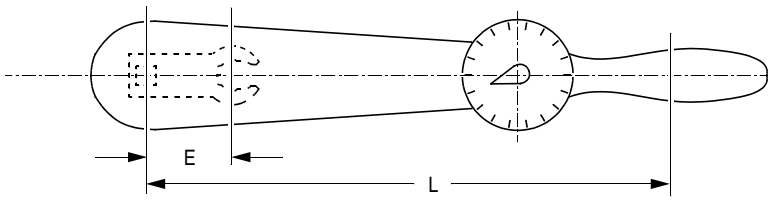
Y = Unknown

L = 10.0 IN.

E = 1.5 IN.

$Y = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$

Y = 117 lb IN.



Formula $\frac{T \times L}{L - E} = Y$

T = 135 LB. IN.

Y = Unknown

L = 10.0 IN.

E = 1.5 IN.

$Y = \frac{135 \times 10}{10 - 1.5} = \frac{1350}{8.5} = 158.82$

Y = 159 lb IN.

LEGEND

T = Desired Torque
Y = Indicated Torque
L = Effective Length Lever
E = Effective Length Of Extension

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Figure 20-605
Torque Wrench Adapter

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